# PCAN-ExpressCard 34

## CAN Interface for the ExpressCard/34 Slot

# User Manual

Document version 1.0.0 (2014-06-02)

PEAK System

## Products taken into account

| Product Name | Model | Part Number |
|---|---|---|
| PCAN-ExpressCard 34 | One CAN channel | IPEH-003004 |

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# 1 Introduction

The CAN adapter PCAN-ExpressCard 34 allows the connection of a CAN bus to embedded PCs and laptops with ExpressCard slots. A galvanic isolation of up to 300 Volts decouples the PC from the CAN bus. Device drivers and programming interfaces exist for different operating systems, so programs can easily access a connected CAN bus.

**Tip:** At the end of this manual (Appendix C) you can find a Quick Reference with brief information about the installation and operation of the PCAN-ExpressCard 34.

## 1.1 Properties at a Glance

- Card for ExpressCard slot
- Type ExpressCard/34 (compatible with ExpressCard/54 slots)
- 1 High-speed CAN channel (ISO 11898-2)
- Compliant with CAN specifications 2.0A (11-bit ID) and 2.0B (29-bit ID)
- Bit rates from 5 kbit/s up to 1 Mbit/s
- CAN bus connection via D-Sub, 9-pin (according to CiA® 102)
- FPGA implementation of the CAN controller (SJA1000 compatible)
- NXP PCA82C251 CAN transceiver
- Galvanic isolation on the CAN connection up to 300 V
- Extended operating temperature range from -40 to 85 °C (-40 to 185 °F)

**Note**: This manual describes the use of the PCAN-ExpressCard 34 with **Windows**. You can find device drivers for **Linux** and the corresponding application information on the provided DVD in the directory branch `Develop` and on our website under www.peak-system.com/linux.

## 1.2 Prerequisites for Operation

- ExpressCard slot in the computer, type ExpressCard/34
- Operating system Windows 8, 7, Vista (32/64-bit) or Linux (32/64-bit)

## 1.3 Scope of Supply

- PCAN-ExpressCard 34 CAN interface
- Device drivers for Windows 8, 7, Vista and Linux (32/64-bit)
- PCAN-View CAN monitor for Windows 8, 7, Vista (32/64-bit)
- PCAN-Basic programming interface consisting of an interface DLL, examples, and header files for all common programming languages
- Manual in PDF format

# 2 Installing the Software and the Card

This chapter covers the software setup for the PCAN-ExpressCard 34 under Windows and the installation in the computer.

Setup the driver before connecting the PCAN-ExpressCard 34 for the first time.

Do the following to install the driver:

1. Make sure that you are logged in as a user with administrator privileges (not needed for normal use of the PCAN-ExpressCard 34 later on).
2. Insert the supplied DVD into the appropriate drive of the computer. Usually a navigation program appears a few moments later. If not, start the file `Intro.exe` from the root directory of the DVD.
3. On the page **English** > **Drivers** activate the entry **PCAN-PCI**.
4. Click on **Install now**. The setup program for the driver is executed.
5. Follow the instructions of the program.

**Tip:** If you do not want to install the CAN monitor PCAN-View for Windows onto the hard disk together with the driver, you have the option to start the program later directly from DVD without prior installation.

- Do the following to connect the PCAN-ExpressCard 34 to the computer and complete the initialization:

  1. Insert the PCAN-ExpressCard 34 into an ExpressCard slot of your computer. The computer can remain powered on.

     Windows notifies that new hardware has been detected.

  2. The drivers are found and installed by Windows automatically.

  3. Afterwards you can work as a user with restricted rights again.

After the initialization process is finished successfully the red LED on the PCAN-ExpressCard 34 is illuminated.

Furthermore, you can find the entry “PCAN-ExpressCard 34” in the branch “CAN-Hardware” of the Windows Device Manager.

# 3 Connecting the CAN Bus

## 3.1 D-Sub Connector

A High-speed CAN bus (ISO 11898-2) is connected to the 9-pin D-Sub connector. The pin assignment corresponds to the specification CiA® 102.

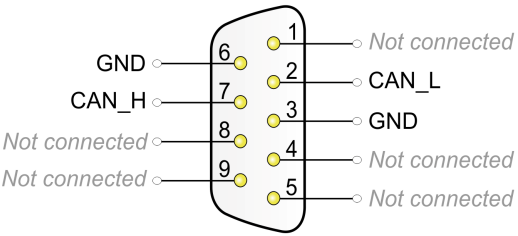


Figure 1: Pin assignment High-speed CAN

## 3.2 Cabling

### 3.2.1 Termination

A High-speed CAN bus (ISO 11898-2) must be terminated on both ends with 120 Ohms. Otherwise, there are interfering signal reflections and the transceivers of the connected CAN nodes (CAN interface, control device) will not work.

The PCAN-ExpressCard 34 does not have an internal termination. Use the adapter on a terminated CAN bus.

### 3.2.2 Example of a Connection

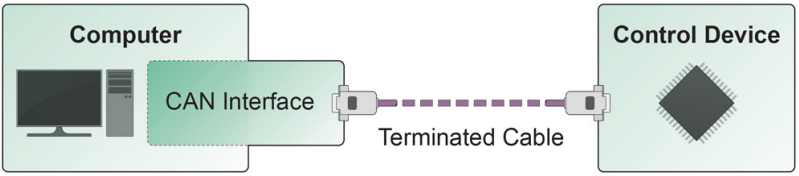


Figure 2: Simple CAN connection

In this example, the PCAN-ExpressCard 34 is connected with a control unit by a cable that is terminated at both ends.

### 3.2.3 Maximum Bus Length

High-Speed-CAN networks may have bit rates of up to 1 Mbit/s. The maximum bus length depends primarily on the bit rate.

The following table shows the maximum possible CAN bus length at different bit rates:

| Bit rate | Bus length |
|---|---|
| 1 Mbit/s | 40 m |
| 500 kbit/s | 110 m |
| 250 kbit/s | 240 m |
| 125 kbit/s | 500 m |
| 50 kbit/s | 1.3 km |
| 20 kbit/s | 3.3 km |
| 10 kbit/s | 6.6 km |
| 5 kbit/s | 13.0 km |

The listed values have been calculated on the basis of an idealized system and can differ from reality.

# 4 Operation

## 4.1 Status LED

The PCAN-ExpressCard 34 has a status LED which may be in one of the following conditions:

| Status LED | Meaning |
|---|---|
| On | There's a connection to a driver of the operating system. |
| Slow blinking | A software application is connected to the CAN channel. |
| Quick blinking | Data is transmitted via the connected CAN bus. |

## 4.2 Removing the Adapter

Under Windows the icon for removing hardware safely is not used with the PCAN-ExpressCard 34. You may remove the card from the computer without any preparation under Windows.

# 5 Using the Software

This chapter covers the provided software PCAN-View and the programming interface PCAN-Basic.

## 5.1 CAN Monitor PCAN-View for Windows

PCAN-View for Windows is a simple CAN monitor for viewing, transmitting, and logging CAN messages.

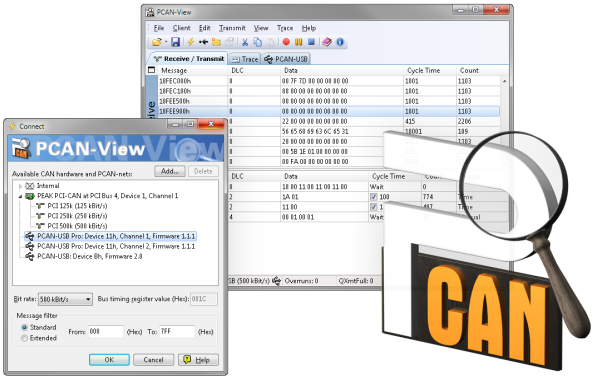


Figure 3: PCAN-View for Windows

Do the following to start and initialize PCAN-View:

1. If PCAN-View is already installed on the hard disk, open the Windows Start menu, go to **Programs** > **PCAN-Hardware**, and select the entry **PCAN-View**.

If you haven't installed PCAN-View together with the device driver, you can start the program directly from the supplied DVD. In the navigation program (`Intro.exe`) go to **English** > **Tools**, and under **PCAN-View for Windows** select the link **Start**.

The dialog box for selecting the CAN hardware and for setting the CAN parameters appears.

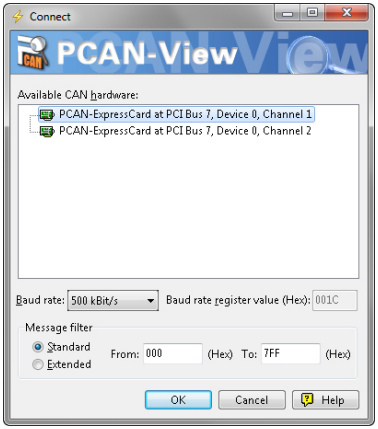


Figure 4: Selection of the CAN specific hardware and parameters

2. From the list **Available CAN hardware** select the CAN channel to be used.
3. From the dropdown list **Bit rate** select the one that is used by all nodes on the CAN bus.
4. Under **Filter settings** you can limit the range of CAN IDs to be received, either for standard frames (11-bit IDs) or for extended frames (29-bit IDs).
5. Finally confirm the settings in the dialog box with **OK**. The main window of PCAN-View appears (see Figure 5).

### 5.1.1 Receive/Transmit Tab

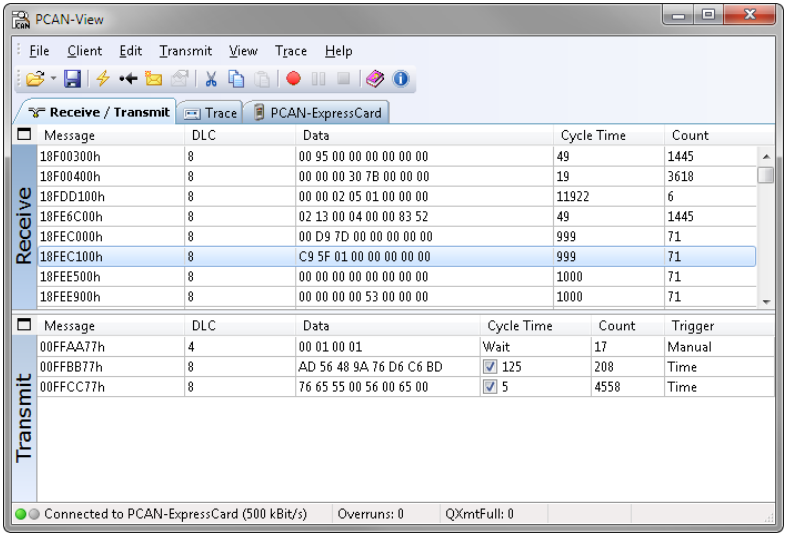


Figure 5: Receive/Transmit tab

The Receive/Transmit tab is the main element of PCAN-View. It contains two lists, one for received messages and one for the transmit messages. Representation of CAN data is in hexadecimal format.

- Do the following to transmit a CAN message with PCAN-View:

1. Select the menu command **Transmit** > **New Message** (alternatively or Ins).

   The dialog box **New Transmit Message** is shown.

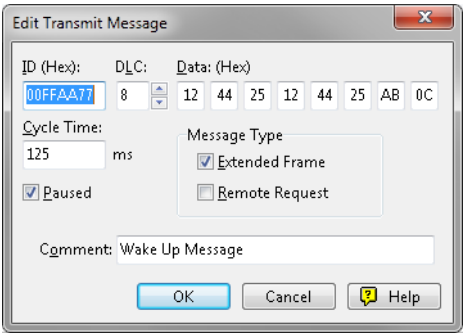


Figure 6: Dialog box New transmit message

2. Enter the ID and the data for the new CAN message.
3. The field **Cycle Time** indicates if the message shall be transmitted manually or periodically. If you want to transmit the message periodically, you must enter a value greater than 0. For a manual-only transmission enter 0.
4. Confirm the entries with **OK**.

   The created transmit message appears on the **Receive/Transmit** tab.
5. You trigger selected transmit messages manually with the menu command **Transmit** > **Send** (alternatively Space bar). The manual transmission for CAN messages being transmitted periodically is carried out additionally.

**Tip**: Using the menu command **File** > **Save** the current transmit messages can be saved to a list and loaded for reuse later on.

### 5.1.2 Trace Tab

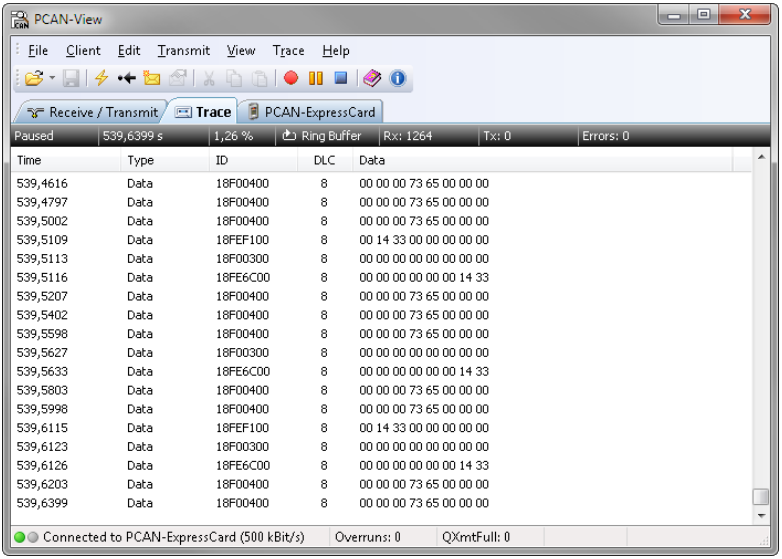


Figure 7: Trace tab

On the Trace tab the data tracer of PCAN-View is used for logging the communication on a CAN bus. During this process the CAN messages are cached in the working memory of the PC. Afterwards they can be saved to a file.

The tracer can be configured to run in linear or in ring buffer mode. In linear buffer mode the logging is stopped as soon as the buffer is filled completely. In ring buffer mode the oldest messages are overwritten by incoming ones.

### 5.1.3 Status Bar

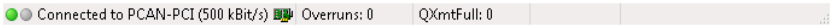


Figure 8: Example of the status bar

The status bar shows information about the current CAN connection, about error counters (Overruns, QXmtFull), and shows error messages.

You can find further information about the use of PCAN-View in the help which you can invoke in the program via the **Help** menu or with the F1 key.

## 5.2 Linking Own Programs with PCAN-Basic

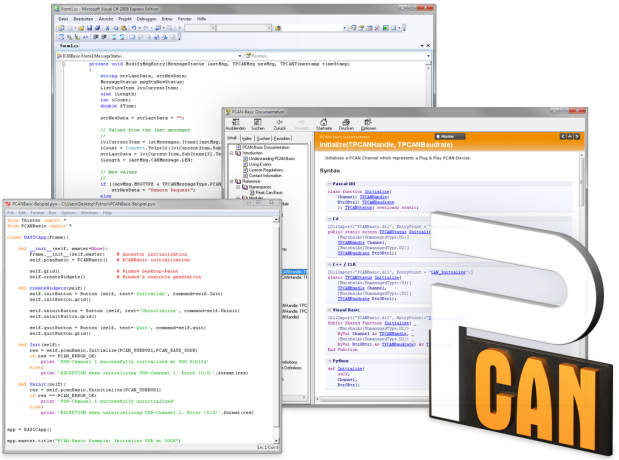


Figure 9: PCAN-Basic

On the provided DVD you can find files of the programming interface PCAN-Basic in the directory branch `Develop`. This API provides basic functions for linking own programs to CAN interfaces by PEAK-System and can be used for the following operating systems:

- Windows 8, 7, Vista (32/64-bit)
- Windows CE 6.x (x86/ARMv4)
- Linux (32/64-bit)

The API is designed for cross-platform use. Therefore software projects can easily ported between platforms with low efforts. PEAK-System has created examples for the following programming languages: C++, C#, C++/CLR, Visual Basic, Delphi, Python, and Java.

### 5.2.1 Features of PCAN-Basic

- Supports Windows 8, 7, Vista (32/64-bit), Windows CE 6.x, and Linux (32/64-bit) operating system
- Multiple PEAK-System applications and your own can be operated on a physical CAN channel at the same time
- Use of a single DLL for all supported hardware types
- Use of up to 8 channels for each hardware unit (depending on the PEAK CAN interface used)
- Simple switching between channels of a PEAK CAN interface
- Driver-internal buffer for 32,768 messages per CAN channel
- Precision of time stamps on received messages up to 1 µs (depending on the PEAK CAN interface used)
- Access to specific hardware parameters, such as listen-only mode
- Notification of the application through Windows events when a message is received
- Extended system for debugging operations
- Multilingual debugging output
- Output language depends on operating system
- Debugging information can be defined individually

An overview of the API functions is located in the header files. You can find detailed information about the PCAN-Basic API on the provided DVD in the text and help files (file name extensions `.txt` and `.chm`).

### 5.2.2 Principle Description of the API

The PCAN-Basic API is the interface between the user application and device driver. In Windows operating systems this is a DLL (Dynamic Link Library).

The sequence of accessing the CAN interface is divided into three phases:

1. Initialization
2. Interaction
3. Completion

#### Initialization

A CAN channel must be initialized before using it. This is done by the simple call of the function `CAN_Initialize`. Depending on the type of the CAN hardware, up to eight CAN channels can be opened at the same time. After a successful initialization the CAN channel is ready for communication with the CAN hardware and the CAN bus. No further configuration steps are required.

#### Interaction

For receiving and transmitting CAN messages the functions `CAN_Read` and `CAN_Write` are available. Additional settings can be made, e.g. setting up message filters to confine to specific CAN IDs or setting the CAN controller to listen-only mode.

When receiving CAN messages, events are used for an automatic notification of an application (client). This offers the following advantages:

- The application no longer needs to check for received messages periodically (no polling).
- The response time at reception is reduced.

#### Completion

To end the communication the function `CAN_Uninitialize` is called in order to release the reserved resources for the CAN channel, among others. In addition the CAN channel is marked as "Free" and is available to other applications.

### 5.2.3 Notes about the License

Device drivers, the interface DLL, and further files needed for linking are property of the PEAK-System Technik GmbH and may be used only in connection with a hardware component purchased from PEAK-System or one of its partners. If a CAN hardware component of third-party suppliers should be compatible to one of PEAK-System, then you are not allowed to use or to pass on the driver software of PEAK-System.

If a third-party supplier develops software based on the PCAN-Basic and problems occur during the use of this software, consult the software provider.

# 6 Technical Specifications

| **Connectors** | |
|---|---|
| Computer | ExpressCard slot, type ExpressCard/34 |
| CAN | D-Sub (m), 9 pins<br>Pin assignment according to specification CiA® 102 |

| **CAN** | |
|---|---|
| Specification | ISO 11898-2, High-speed CAN<br>2.0A (standard format) and 2.0B (extended format) |
| Bit rates | 5 kbit/s - 1 Mbit/s |
| Controller | FPGA implementation (SJA1000 compatible) |
| Transceiver | NXP PCA82C251 |
| Galvanic isolation | Up to 300 V |
| Termination | none |

| **Supply** | |
|---|---|
| Supply voltage | 1.5 V und 3.3 V |
| Current consumption | 1.5 V: max. 180 mA<br>3.3 V: max. 330 mA |

| **Measures** | |
|---|---|
| Size | 108 x 37 x 20 mm (L x W x D)<br>See also dimension drawing in Appendix B on page 25 |
| Weight | 32 g |

| **Environment** | |
|---|---|
| Operating temperature | -40 - 85 °C (-40 - 185 °F) |
| Temperature for storage and transport | -40 - 85 °C (-40 - 185 °F) |
| Relative humidity | 15 - 90 %, not condensing |
| EMC | EN 55024:2011-09<br>EN 55022:2011-12<br>EC directive 2004/108/EG |
| Ingress protection (IEC 60529) | IP30 |

# Appendix A CE Certificate

PCAN-ExpressCard 34 IPEH-003004 – EC Declaration of Conformity
PEAK-System Technik GmbH

**Notes on the CE Symbol** CE

The following applies to the "PCAN-ExpressCard 34" product with the item number(s) IPEH-003004.

**EC Directive** This product fulfills the requirements of EU EMC Directive 2004/108/EG (Electromagnetic Compatibility) and is designed for the following fields of application as for the CE marking:

**Electromagnetic Immunity**
DIN EN 55024, publication date 2011-09
Information technology equipment – Immunity characteristics – Limits and methods of measurement (CISPR 24:2010);
German version EN 55024:2010

**Electromagnetic Emission**
DIN EN 55022, publication date 2011-12
Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement (CISPR 22:2008, modified);
German version EN 55022:2010

**Declarations of Conformity** In accordance with the above mentioned EU directives, the EC declarations of conformity and the associated documentation are held at the disposal of the competent authorities at the address below:

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Mr. Wilhelm
Otto-Roehm-Strasse 69
64293 Darmstadt
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Phone: +49 (0)6151 8173-20
Fax: +49 (0)6151 8173-29
E-mail: info@peak-system.com

Signed this 2nd day of June 2014

# Appendix B Dimension Drawing

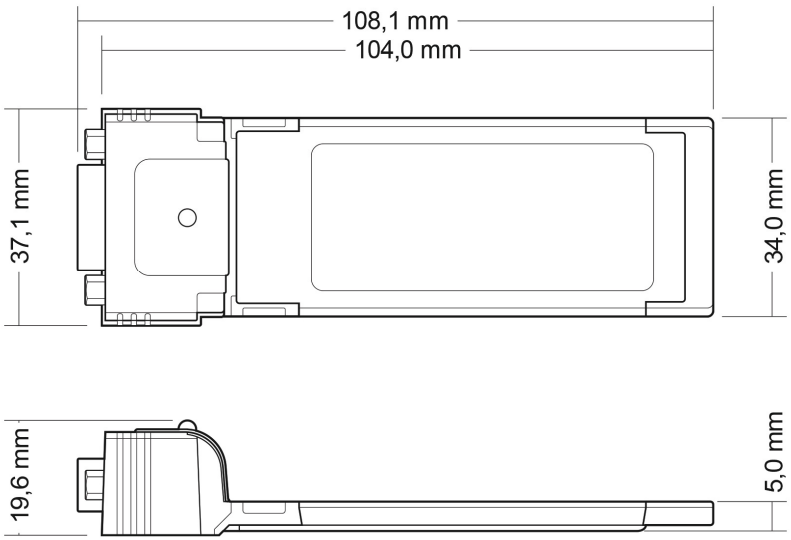


Figure 10: Side view and top view of the PCAN-ExpressCard 34

The figure does not show the actual size of the product.

# Appendix C Quick Reference

## Software/Hardware Installation under Windows

Before connecting the PCAN-ExpressCard 34 to the computer set up the corresponding software package from the supplied DVD (with administrator privileges). Afterwards insert the card into a ExpressCard slot of the computer. The card is recognized by Windows and the driver is initialized. After the installation process is finished successfully, an LED is on for each CAN channel of the card. After the installation process is finished successfully you can find the entry “PCAN-ExpressCard 34” in the branch “CAN-Hardware” of the Windows Device Manager.

## Getting Started under Windows

Run the CAN monitor PCAN-View from the Windows Start menu as a sample application for accessing the PCAN-ExpressCard 34. For initialization of the card select the CAN connection and the CAN bit rate.

| Status LED | Meaning |
|---|---|
| On | There's a connection to a driver of the operating system. |
| Slow blinking | A software application is connected to the CAN channel. |
| Quick blinking | Data is transmitted via the connected CAN bus. |

## High-speed CAN connector (D-Sub, 9 pins)